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Implementation, Utilization and Assessment of Innovative Agricultural Technologies in Rural Bangladesh

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HORTICULTURE INNOVATION LAB
UC DAVIS UNIVERSITY OF CALIFORNIA
Helen Keller INTERNATIONAL
Tufts UNIVERSITY
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PROJECT DETAILS

- **Goal:** improve access to nutrient-rich foods that can enhance diet quality and nutrition of rural smallholders
- **Project Coverage:** 2 divisions; 8 districts; 108 direct beneficiary households
- **Technologies tested:**
  - Drying: Chimney Solar Dryers
  - Storage: Coolbot™ Cold Rooms
  - Production: Floating Gardens
- The pilot testing was complemented with several data collection activities
  - Technology and cost monitoring data collection
  - Repeat panel households surveys
  - A qualitative survey close to end line of the project

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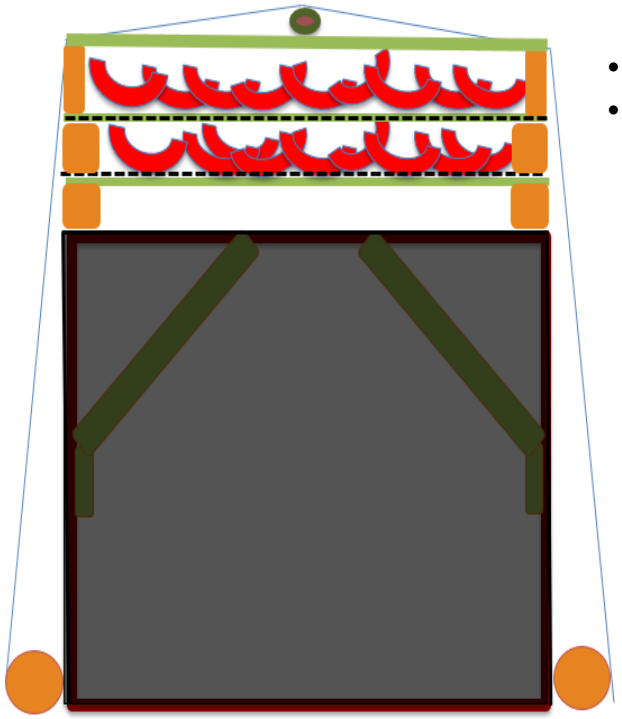
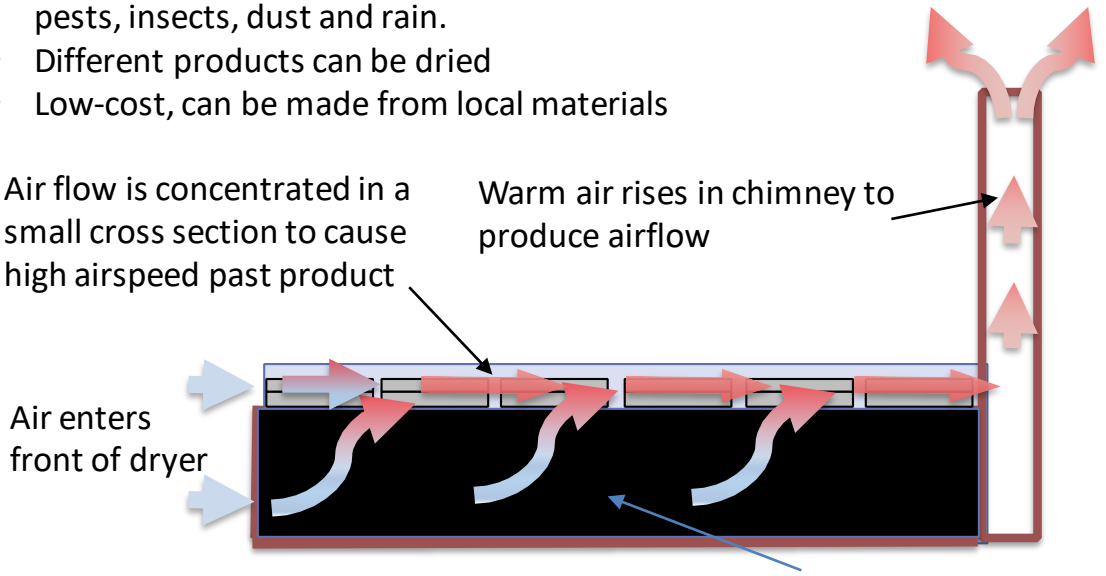
CHIMNEY SOLAR DRYER



- Faster drying compared to other designs or traditional drying
- Plastic cover protects food products from contamination of pests, insects, dust and rain.
- Different products can be dried
- Low-cost, can be made from local materials



Approximate materials cost in Bangladesh: $120

80 cm high 'table' covered with black plastic or cloth. Clear plastic film is placed over the trays and the sides of the table.

IMPLEMENTATION- CHIMNEY SOLAR DRYER

- 3 Chimney Solar Dryers (1 for fish and 2 for fruit/vegetable drying)
- Implemented February-March 2016
- Shared by local communities of 3 upazillas

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CoolBot Cold Rooms

CoolBot room cost

CoolBot unit	$350
Inverter A/C:	$1,200
PUF Panels:	$5,500
Generator & voltage stab.:	$2,500
Electricity connection:	$250-650
Installation	$2,500
TOTAL	**ca. $12,500**
Electricity cost/year:	$300-400

IMPLEMENTATION – COOLBOT COLD ROOMS

- Three cold rooms implemented June 2016, February 2017, August 2017
- Financial support reduced in two stages
  - After operational for 1 year, 25% support continued for the next 3 month
  - No financial support after 3 months
  - Technical assistance continued
- In September 2018, entrepreneurship trainings
- Rooms underutilized
  - Crop calendar updated with storage suggestions for each location
  - Fruit sellers renting cold room space during lean season
  - Further entrepreneurship training needed

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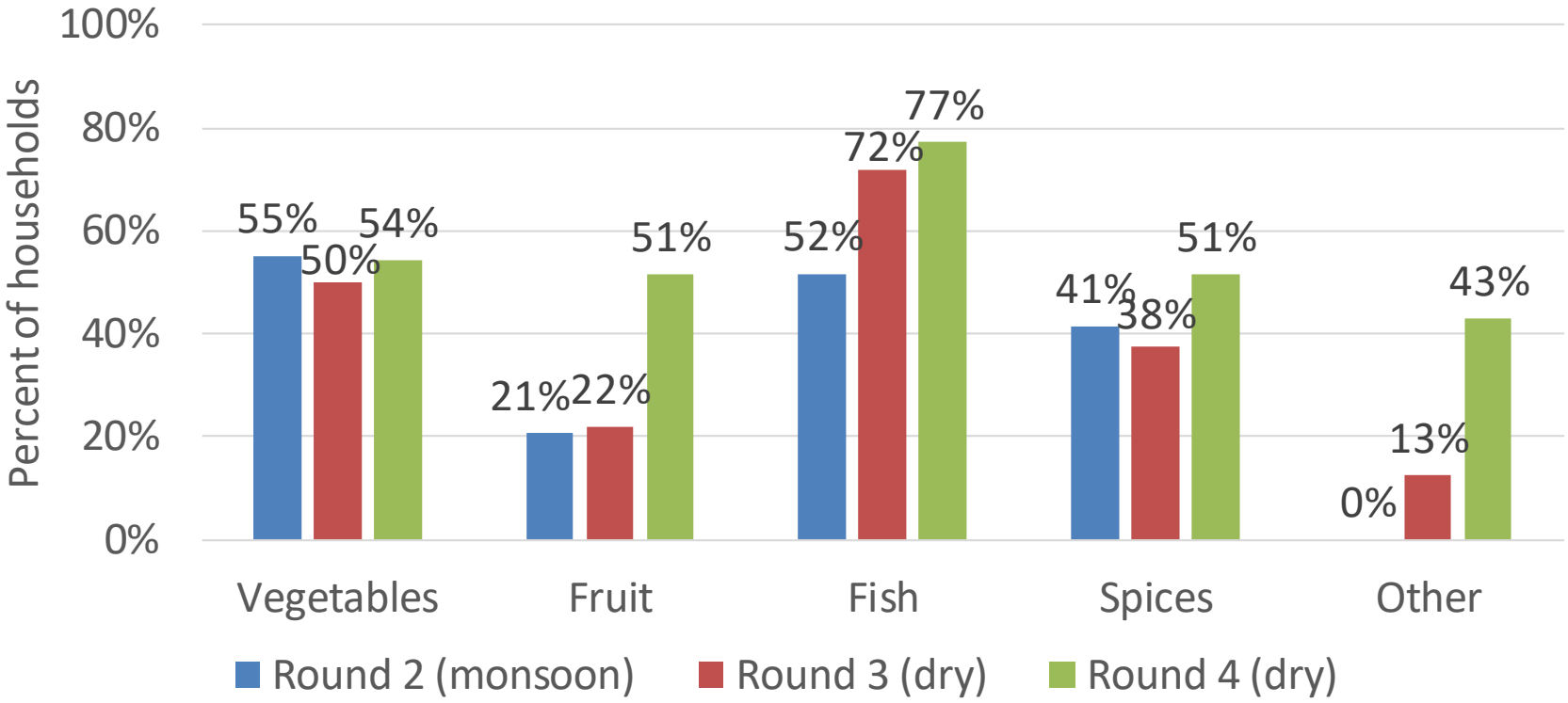
CHIMNEY SOLAR DRYERS

Use of Chimney Solar Dryer across three survey rounds



PERCEIVED BENEFITS OF CHIMNEY SOLAR DRYER

*"…is **easy to construct** with local materials, and **easy to maintain**, just need to change the plastics in few months time."*

- *"…can **dry faster** than traditional method. On clear sunny days, it used to take 5 days to dry, our fish, with chimney dryer, it takes 3 days."*
- *"…keeps food **safe, closed and protected** from dirt and dust, insects, rodents, dogs, cattle, mosquito eggs, etc."*
- *"…gives **better color, smell and taste** of dried fish than the one dried using traditional method. No pesticides used during washing of vegetable products"*
- *"…..helps us get **better price**, almost double, for dried fish and vegetables. We **make good profit** selling vegetables and fish!*

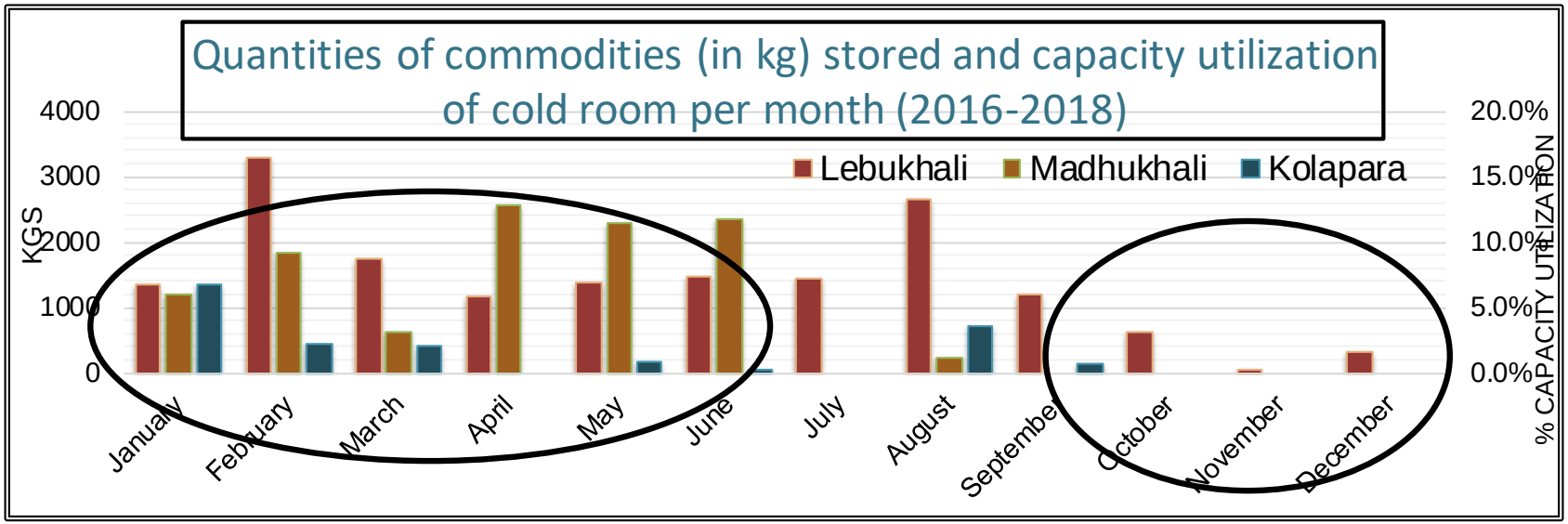
PERCEIVED BARRIERS/CHALLENGES – CHIMNEY SOLAR DRYER

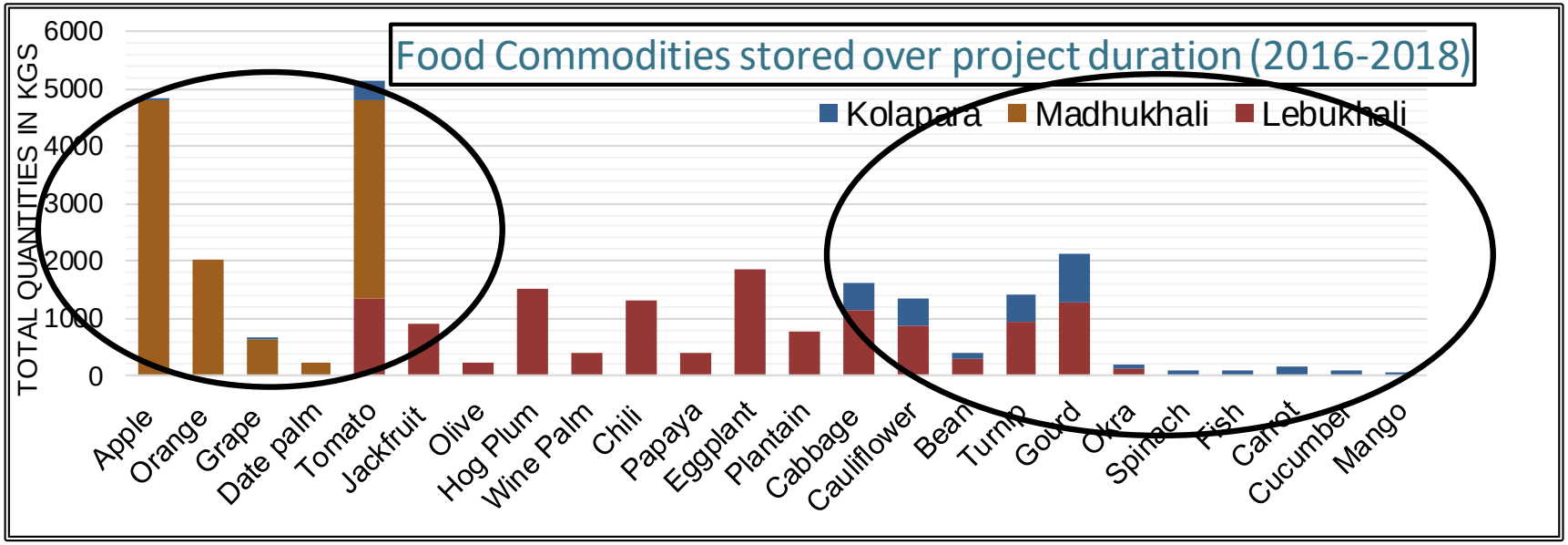
- *"….**Winter is not the prime drying season** for drying, so cannot use the dryer."*
- *…the **dryer is small** and we need bigger ones to dry our products."*
- *"…**did not see benefit** by drying products in the chimney dryer. There is no change in profit for me."*
- *"…..we were just **not interested** in the dryer."*

SUCCESSES & OPPORTUNITIES

- One community built a second dryer for extra capacity
- WorldFish scientists saw opportunities for fish drying and built 7 dryers in local communities near the sea
  - 3 dryers built in Kolapara and 4 in Nidrachar
  - Trained farmers that built dryers have been hired by WorldFish to provide construction, repair service, and training
- WorldFish building 26 dryers in 2 upazillas in Coxsbazar with funding from WFP; also training 480 women to build and use dryers

COOLBOT™ COLD ROOMS





Decisions to store better market value crops resulted in better economic performance of the cold room. However, continued and maximum utilization of capacity is critical to better economic performance and sustenance of cold room, irrespective of the value of crops stored

PERCEIVED BENEFITS OF COOLBOT COLD ROOMS

- *"…..during festivals like Eid, Bengali New Year,*
- *market price for pomelo, lemon, eggplant, tomato, cucumber is high so we **make profit** by storing the products for 15-30 days before the festival."*

- *"…the **quality of products stored is good** and we get better market price. The products are free of chemicals."*

- *"..we can **store the vegetables for a longer period** of time."*

PERCEIVED BARRIERS – COLD ROOMS

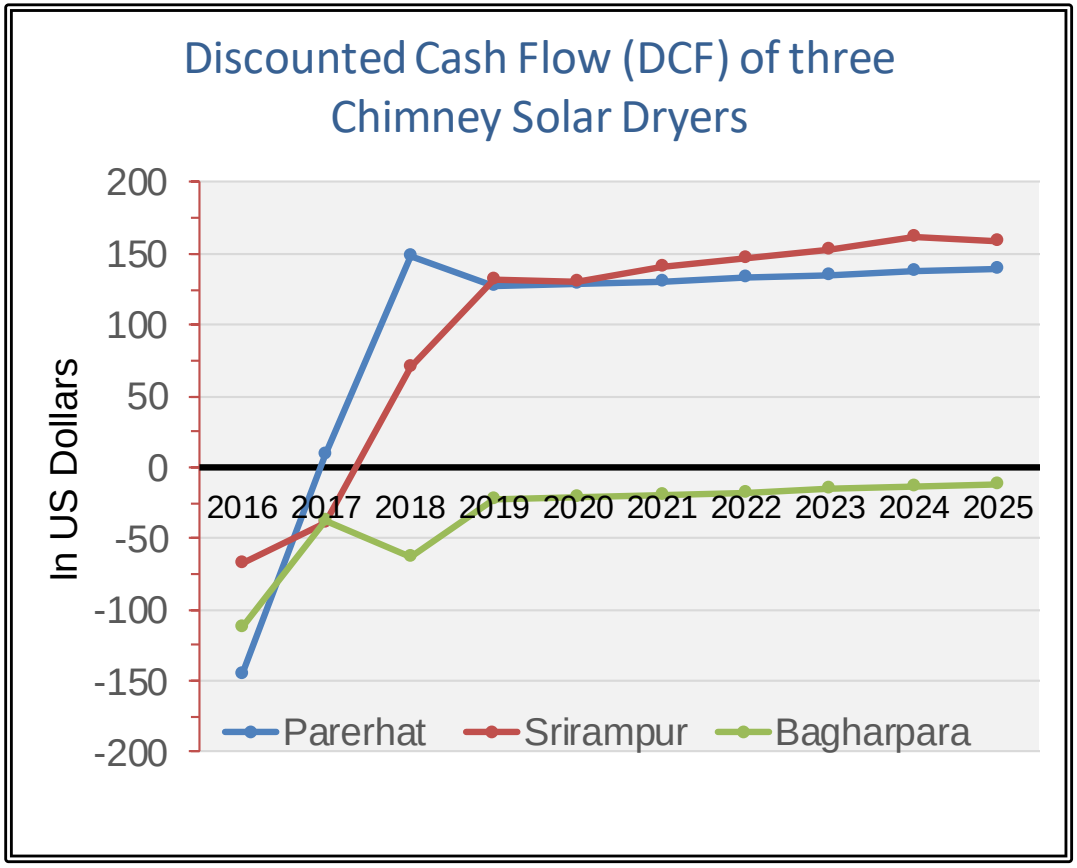
- *"…**arranging stable electricity supply and generator operations cost** is a big challenge. Construction takes a lot of time."*
- *"…**did not see benefit** by storing products in the cold rooms. There is no change in profit for me, and the market is unstable."*
- *"…we **were not allowed to store products** like fish and shrimps."*
- *"…..**limited availability of commercial vendors** to partner with."*

DATA COLLECTION AND ANALYSIS – OBJECTIVE II

All three technologies were subjected to cost-benefits analysis using a Land Use System (LUS) approach that tracks the flow of inputs and outputs over the life of the technology.

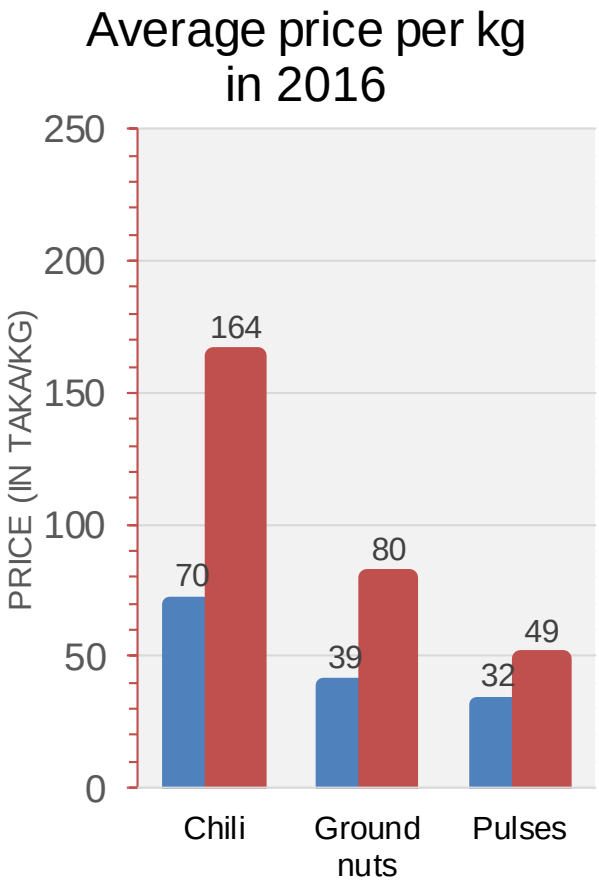
Data were collected on a bi-weekly basis over three years by Horticulture Innovation Lab staff

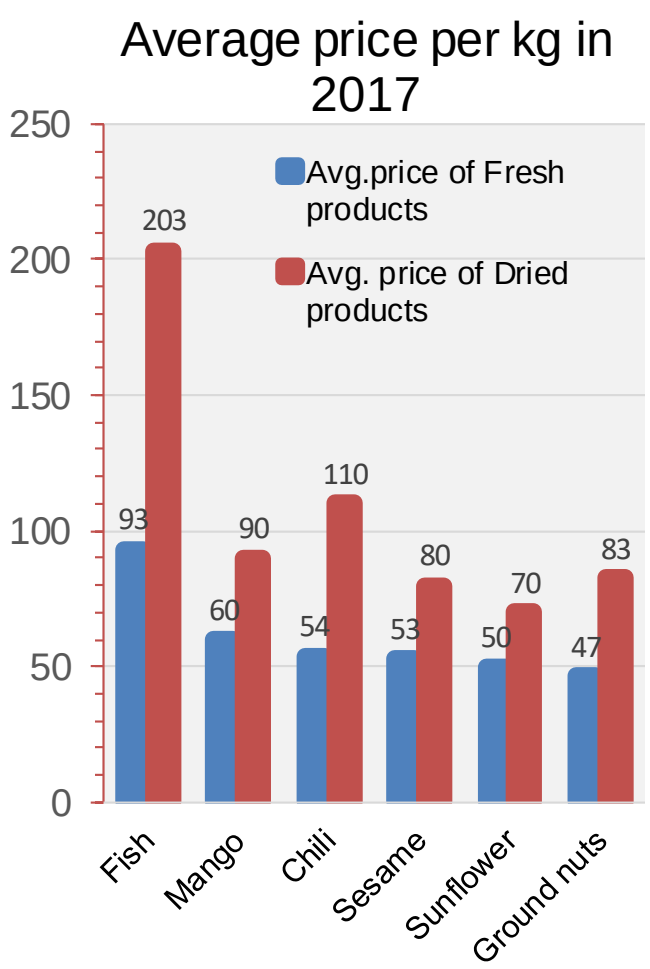
ECONOMIC ANALYSIS - CHIMNEY SOLAR DRYERS

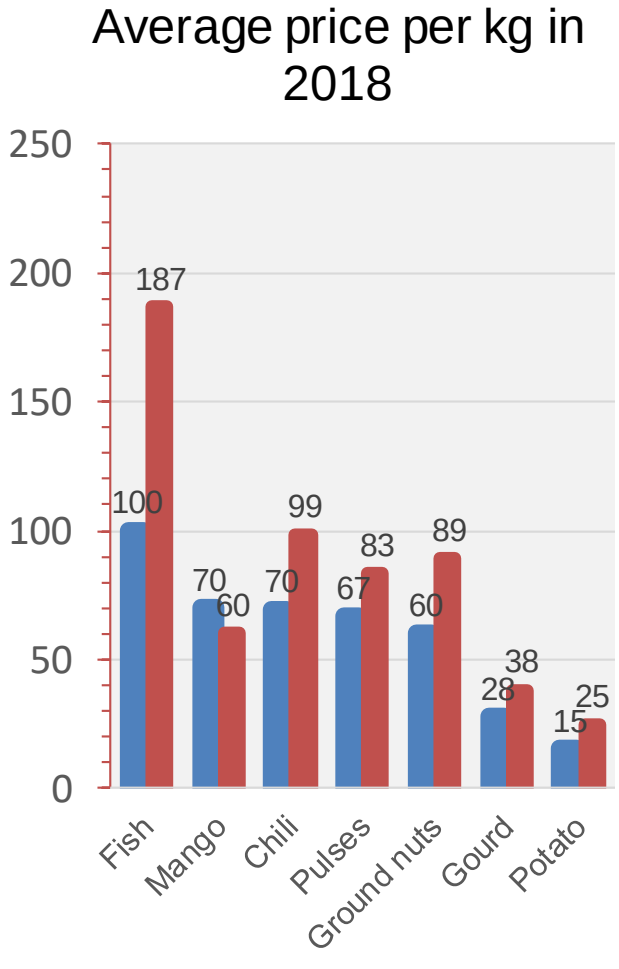


- The dryer in Bagharpara was used to dry low value crops – cabbage, gourd, mango and banana. The revenue stream never surpassed the costs.
- ***Economic performance of technologies like the chimney solar dryer varies significantly depending on the products being dried (high vs low value crops, as well as the product unit prices.***

VARIATION IN MARKET PRICES FOR FRESH VS DRIED PRODUCTS



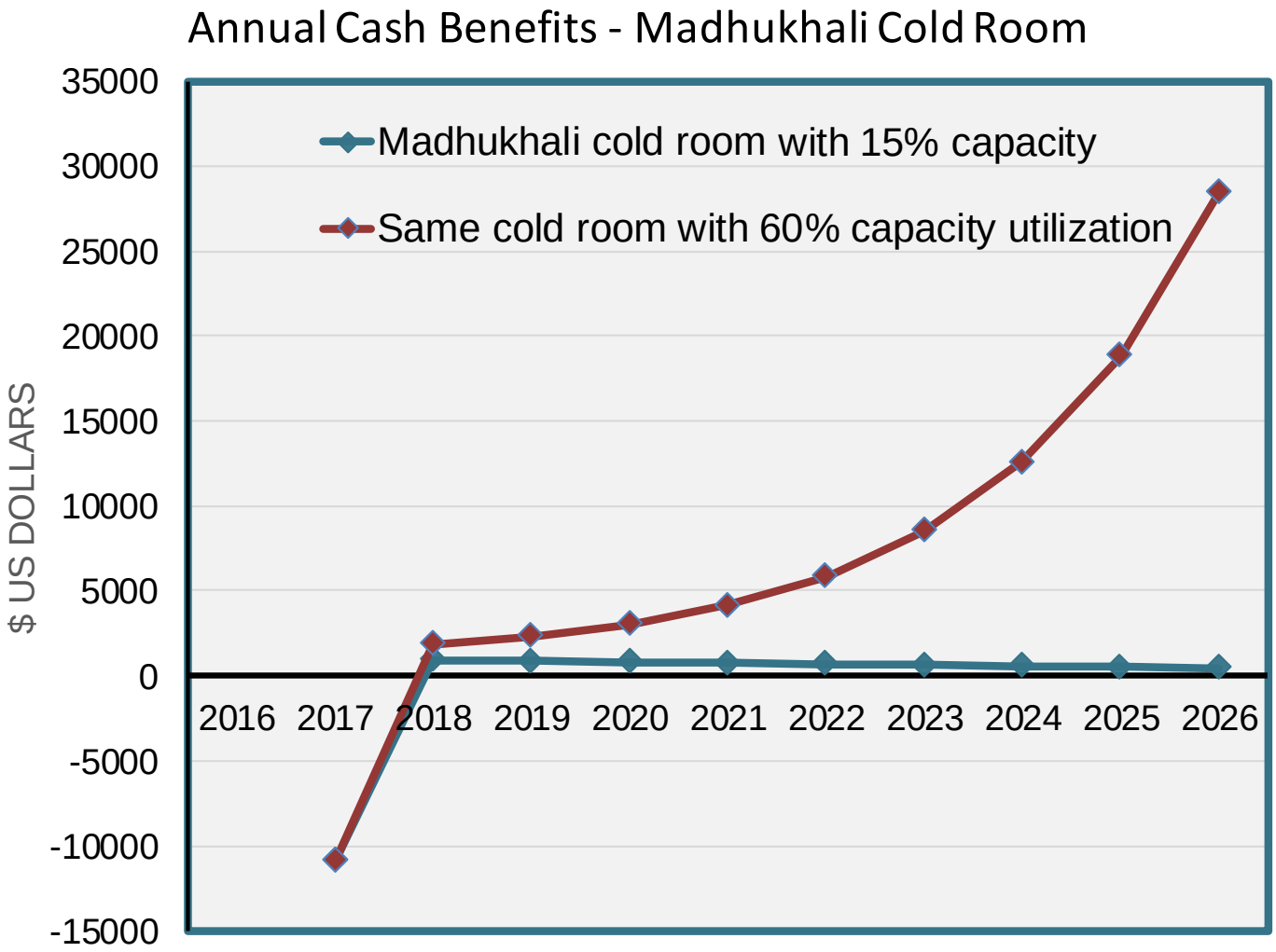




LESSONS LEARNED – CHIMNEY SOLAR DRYERS

- Some products are not cost effective to dry because the value added to the dried product is not sufficient to offset the loss in weight from drying
- Drying products with high dried-product unit price, as well as products with a large difference between fresh and dried unit prices, helps to promote economic viability.
- ***Prototypes with larger drying space can significantly impact the economic feasibility and utilization the dryers, especially among households engaged in enterprise focused on aquatic products.***

ECONOMIC ANALYSIS - COLD ROOMS



- Scenario Analysis showing 60% increase in storage results in positive net present value after 5 years.

LESSONS LEARNED – COLD ROOMS

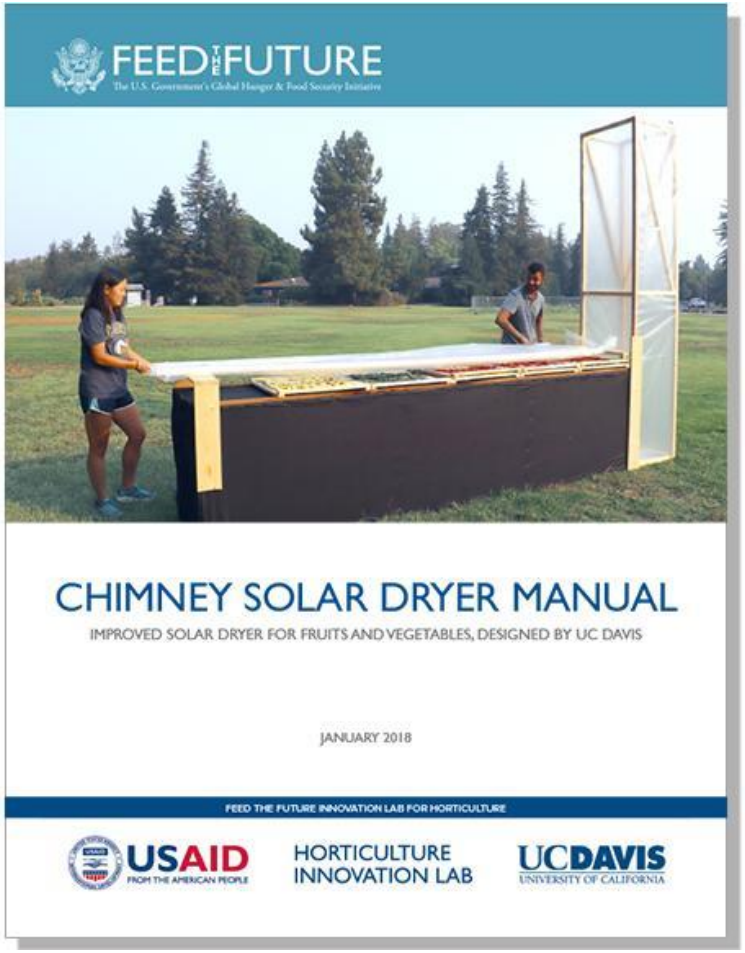
- High establishment costs and low usage rates reduced the economic feasibility of cold rooms.
- Further educational outreach and training is needed to encourage increased use of cold room.
- Locations of cold rooms was not ideal. Cold rooms may be more utilized further downstream in supply chain.
- Weather events can change attitudes towards use of cold room
- ***Subsidies that can offset establishment costs will significantly improve the economic feasibility and utilization of this technology.***

KEY TAKE AWAYS

- Solar Dryer: Prototypes with larger drying space can significantly impact the economic feasibility and utilization the dryers, especially among households engaged in enterprise focused on aquatic products.

- Cold Room: Subsidies that can offset establishment costs and increased utilization of cold room space will significantly improve the economic feasibility of this technology. Location of cold room is a critical factor.

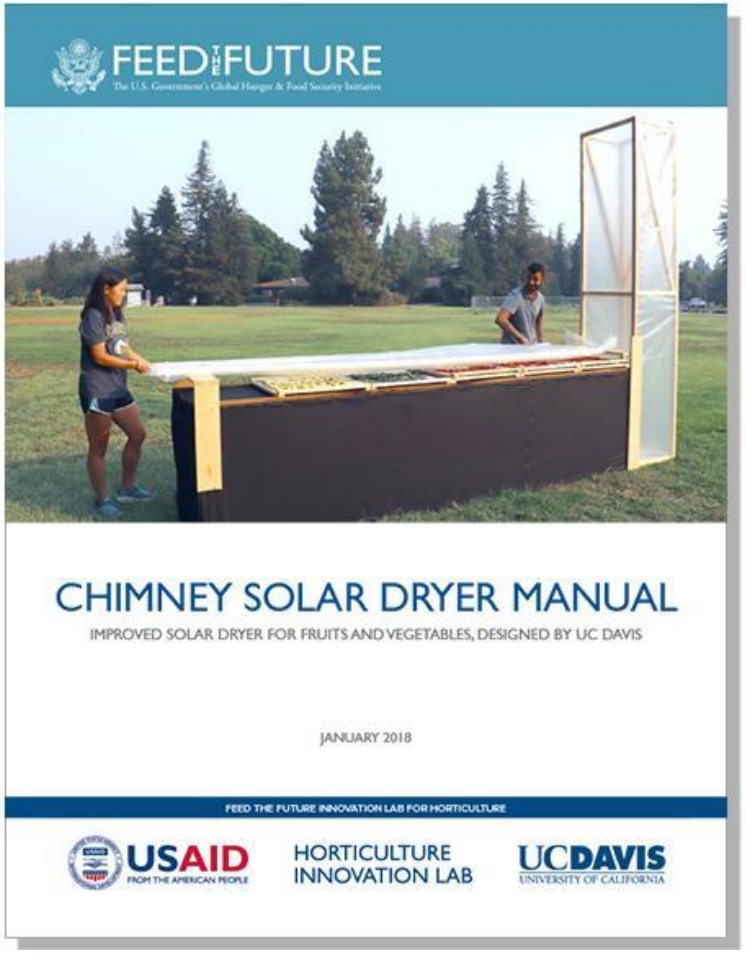
- Floating Gardens: This technology is aimed at improving availability and access (consumption) of nutrient rich foods in poorer households, with less focus on economic benefits.



Manual and Videos Available

- How to build
- How to use
- Training manuals

http://horticulture.ucdavis.edu/postharvest



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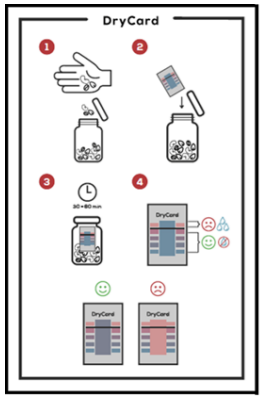
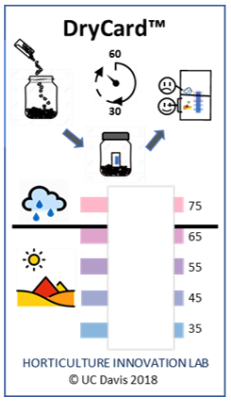
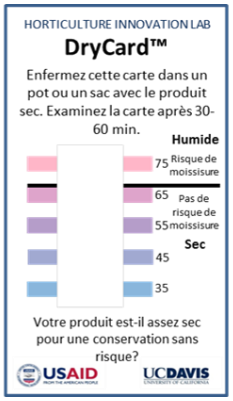
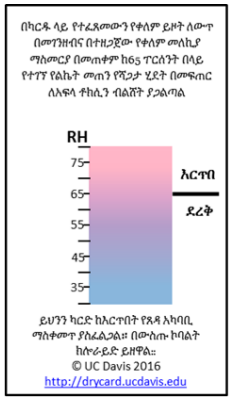
DryCard™

The DryCard™









- To make the $CoCl_2$ test useful, we have fabricated a simple card that can be carried in a wallet or purse and can be used to measure ERH
- It comprises a printed card and a strip of $CoCl_2$ RH indicator paper. The card is laminated into a polyethylene envelope containing a window that allows the $CoCl_2$ paper to respond rapidly to the ambient RH
- A color reference scale is printed on the card to indicate the moisture content of the product
- The material cost of the card is very low (ca. US$ 0.10) and can be sold for $1 each.

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